

PULSAtrol™

Microprocessor-Based Water Treatment Controller

Model Number

MCT130

Software Version 2.XX

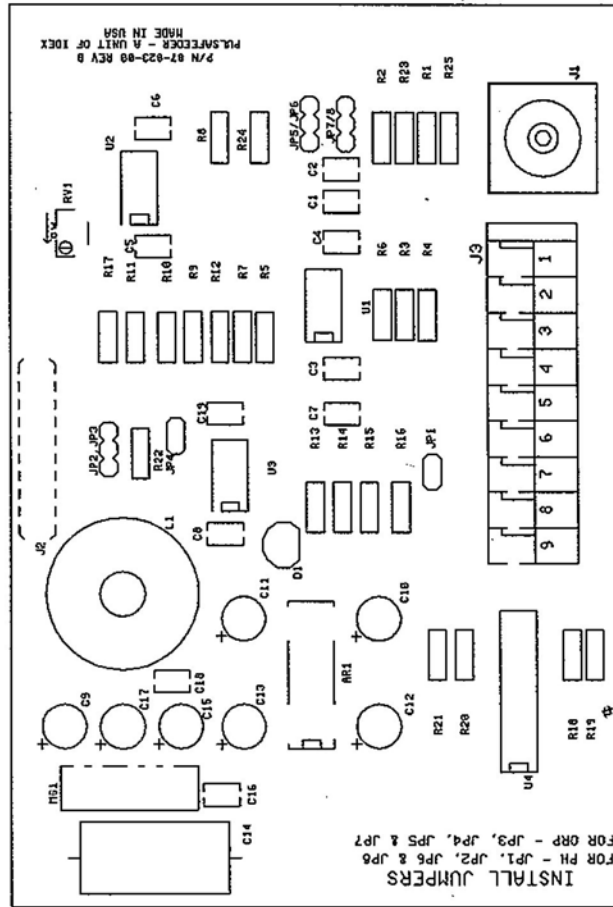
INSTALLATION OPERATION MAINTENANCE INSTRUCTION

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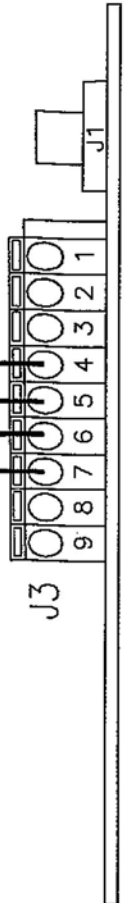
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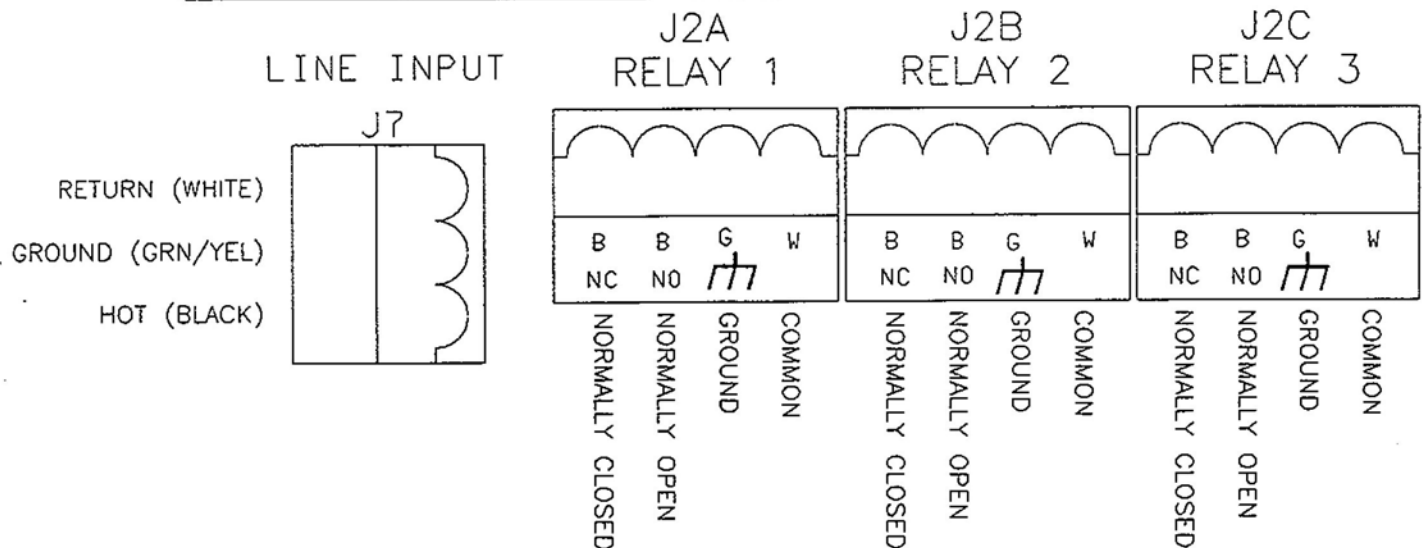
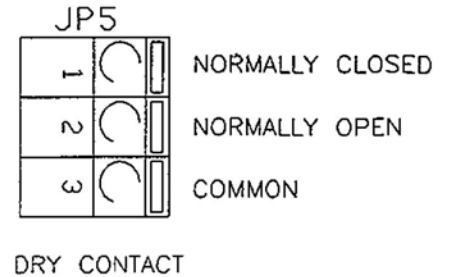
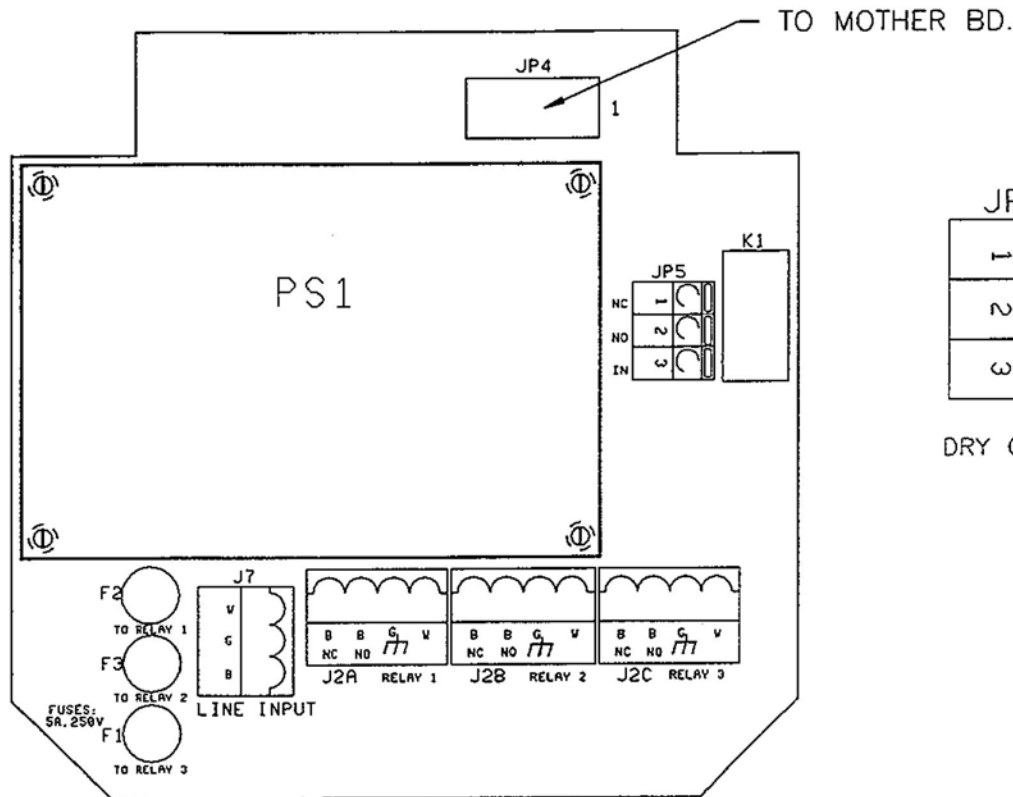
pH/ORP BOARD



WATER METER — FLOW SWITCH



100 SERIES POWER SUPPLY / RELAY BD. CONNECTIONS



		RELAY 1	RELAY 2	RELAY 3
COOLING TOWER	MCT110	BLOWDOWN	INHIBITOR	
	MCT110C	BLOWDOWN	TIMER OUT 1	
	MCT120	pH CONTROL		
	MCT120C	pH CONTROL	TIMER OUT 1	
	MCT130	ORP CONTROL		
	MCT130C	ORP CONTROL	TIMER OUT 1	
BOILER	OPTION "D"			ALARM RELAY
	MBC110	BLOWDOWN	** BLOWDOWN	
	MBC110C	BLOWDOWN	** BLOWDOWN	TIMER OUT 1
	MBC110D	BLOWDOWN	** BLOWDOWN	ALARM RELAY
TIMER	MPT110	LOCKOUT	BIO A	
	MPT120	LOCKOUT	BIO A	BIO B
	MPT150	TIMER OUT 1		
	MPT150H	TIMER OUT 1	28 DAY TIMER	
	OPTION "D"			ALARM RELAY

** NOTE: WHEN RELAY #1 IS ON RELAY #2 IS OFF AND VICE VERSA

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This manual describes the standard model MCT130. If your controller is supplied with options refer to the pages following this manual for a description of each optional feature and its effect on operating procedures.

IMPORTANT

Before proceeding, read the red card in the front of the controller. It contains important information about start-up. Refer to Figure 7, Mother Board.

Introduction

The PULSAtrol™ series of microprocessor based controllers have been designed with the capability to control and monitor a wide range of parameters, both analog and digital.

This instruction manual is based on the model number of your controller and covers those functions found on your controller. For your convenience, there is an abbreviated instruction and software "MENU MAP" laminated card supplied with all manuals to be kept with the controller. This card is not a substitute for this instruction manual. It is supplied as a quick reference only and should be used in conjunction with the instruction manual.

Take a moment to review Figure 1, MCT130 front panel and become familiar with the PULSAtrol™ Series 100 controller.

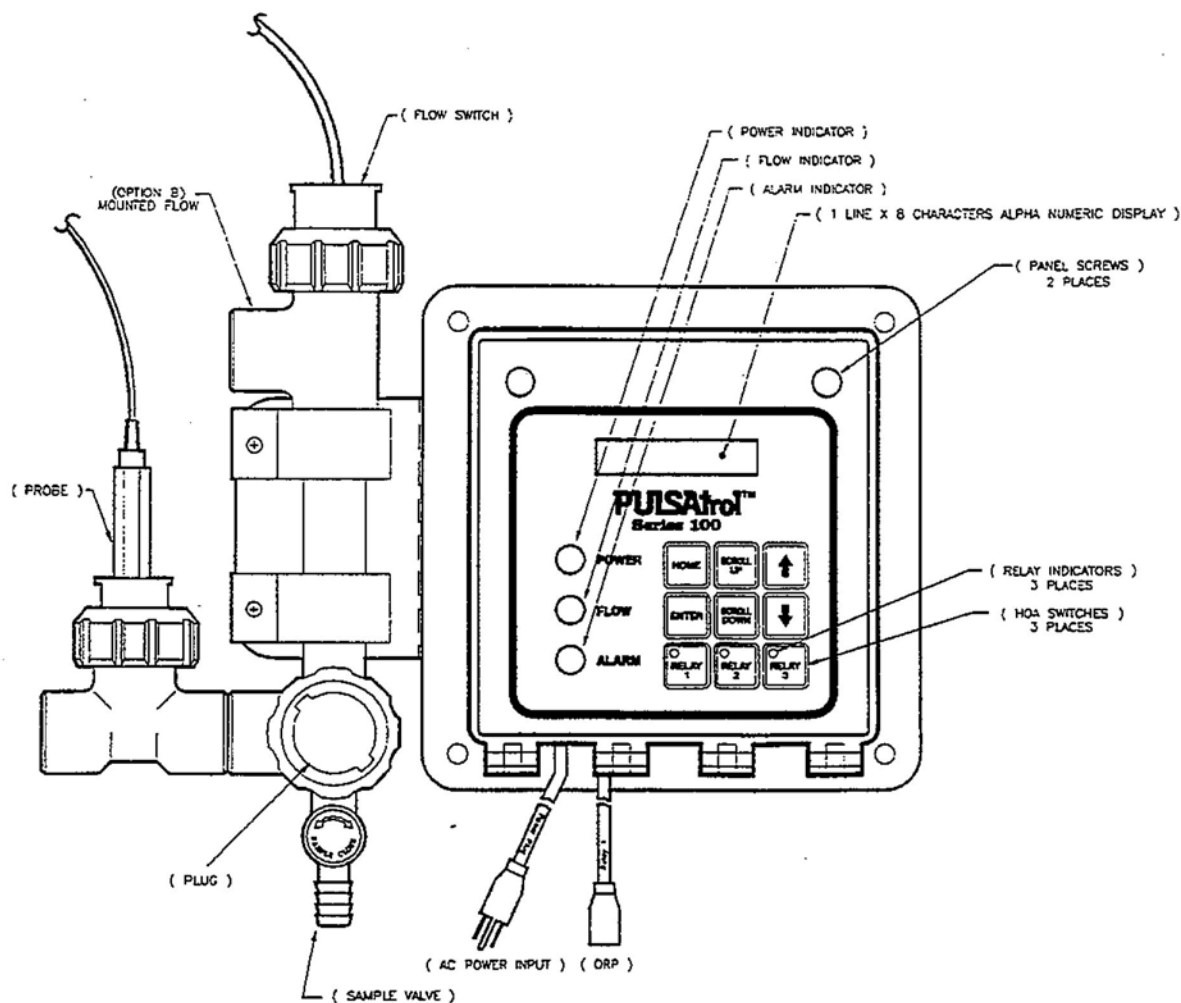


Figure 1, MCT130 Front Panel

Description

The MCT130 is designed to monitor and control ORP with a control set point in millivolts (mV) entered into the MCT130 through the keypad. The set point has a built-in limit timer that acts as a fail-safe to prevent system overfeed.

The design also includes a high/low alarm indicator available with optional relay output and/or dry contacts. The alarms can be operated in one of two modes: follow set point, in which an alarm offset is entered and the alarms automatically adjust themselves around the set point or independently set, which allows you to independently set both the high and low alarms.

Hand/Off/Auto keys are provided on the keypad for immediate control of pumps, solenoid valves, etc., without scrolling through menus. The design allows the MCT130 to accept options such as Analog Output and/or Mounted Flow Assembly with Flow Switch. All inputs are fully isolated, effectively eliminating ground loops and other interference found in the industrial environment.

How to Use this Manual

For easy reference, the functions on the PULSAtrol™ controller discussed in this manual are illustrated as follows:



= The keys on the keypad which you are required to push for the function described.



= The main menu displayed for the function described.

Warranty

Pulsafeeder, Inc. warrants PULSAtrol™ control systems of its manufacture to be free of defects in material or workmanship. Liability under this policy extends for 24 months from date of shipment. The manufacturer's liability is limited to repair or replacement of any failed equipment or part which is proven defective in material or workmanship upon manufacturer's examination. This warranty does not include removal or installation costs and in no event shall the manufacturer's liability exceed the selling price of such equipment or part.

The manufacturer disclaims all liability for damage to its products through improper installation, maintenance, use or attempts to operate such products beyond their functional capacity, intentionally or otherwise, or any unauthorized repair. The manufacturer is not responsible for consequential or other damages, injuries or expense incurred through the use of its products.

The above warranty is in lieu of any other warranty, whether expressed or implied. The manufacturer makes no warranty of fitness or merchantability. No agent of ours is authorized to provide any warranty other than the above.

FCC Warning

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communications. It has been type tested and found to comply with the limits for a class A computing device pursuant to subpart J of part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial or industrial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures necessary to correct the interference.

Specifications *(Factory settings are default values)*

General

Power Input	110/220 VAC @ 50/60 Hz 100 VA.
Control Output	Line voltage @ 600 VA (5 amp @ 115 VAC) per relay.
Enclosure Prewired	High impact resistant PVC designed to NEMA 4X, with convenient molded receptacle cords and power cord with molded plug for electrical connections.
Enclosure Conduit	High impact resistant PVC designed to NEMA 4X, factory predrilled with easily accessible terminals for hard wiring.
Display	Alphanumeric 1 line by 8 character lighted LCD display.
H/O/A Switches	Front panel keypad.
Environment	Ambient temp. 0°F (-17.8°C) to 122°F (50°C); relative humidity 0 to 100%.
Dimensions	Width 7" (17.78 cm) X height 7" (17.78 cm) X depth 6.5" (16.51cm).
Controller Weight	6 lbs (2.7 kgs)
Shipping Weight	8 lbs (3.6 kgs)
Flow Switch or Interlock	Connection provided. Function activated by dip switch if mounted flow switch or remote flow switch not ordered with controller.
Inputs	1 analog and 2 digital
Outputs.....	1 analog and 2 relays

ORP Function

Electrode	TON-1 sealed combination type; KCl-AgCl reference with 3/4" glass filled polypropylene flow tee. 125 psi (8.65 BAR) @ 125°F (52°C).
Set Point.....	Select rising or falling; factory set falling 870 mV.
Range.....	0 to 1000 mV
Accuracy	+/- 1% of full scale, at point of measure, excluding electrode.
Differential	Adjustable; factory setting 20 mV.
Hi/Lo Alarm	Adjustable select follow set point or independent set of HIGH and LOW. Factory setting follow set point +/- 25 mV.

Limit Timer Adjustable in one (1) minute increments up to 24 hours, factory set at 1:30 hr/min.

Summary Of Keypad

Home When pushed, returns displayed menu back one level in the menu structure.

Enter When pushed, enters displayed variable or value.

Scroll Up Used to scroll up through (view) menu structure.

Scroll Down Used to scroll down through (view) menu structure.

Arrow Keys Used to move between variables and to increase or decrease numerical settings.

Relay Keys Hand/Off/Auto (HOA) switches. Pressing key:
ONCE forces corresponding output relay on for five minutes; LED color amber.
TWICE forces corresponding output relay off indefinitely; LED color red.
THREE times returns control to automatic; LED off if within set point, green if out of set point.

Summary Of LED Indicator Lights

Power Indicator Illuminates when power is supplied to unit.

Flow Indicator Illuminates when flow is present through flow switch. This indicator will not be functional or labeled if mounted flow assembly was not ordered. User can activate function on site.
Green - Indicates flow

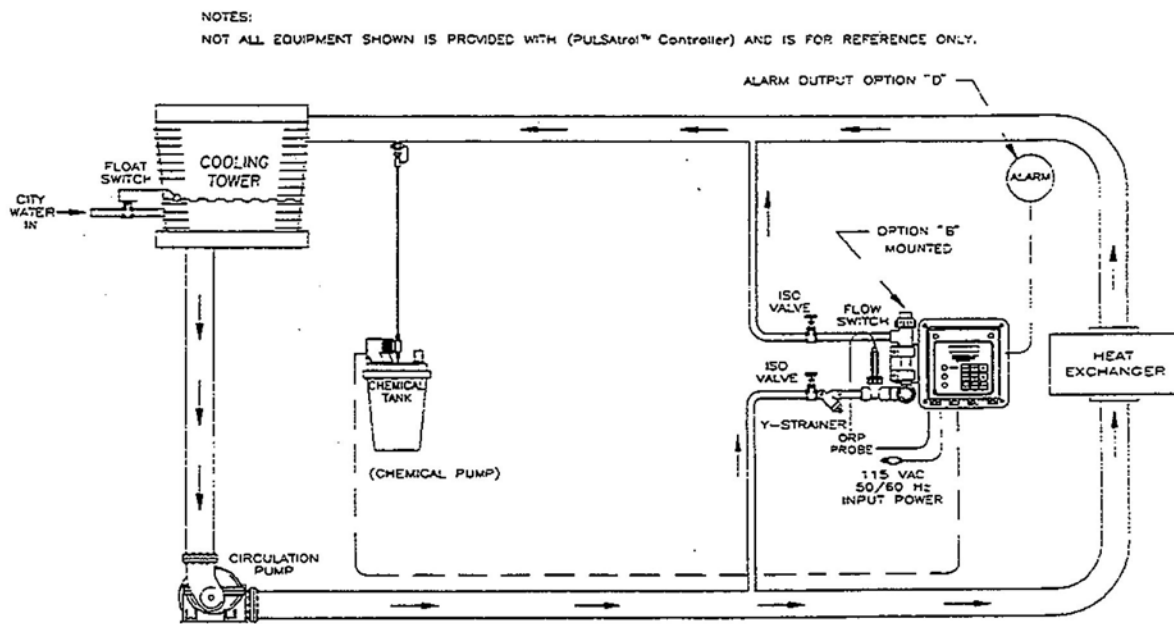
Alarm Indicator Flashes red when an alarm condition is present.

Relay Indicators AMBER if forced on.
RED if forced off.
OFF if in auto mode and control function is not automatically activated.
GREEN if activated automatically.

Section 1 - Installation

Location

Select a mounting location convenient to grounded electrical and plumbing connections. Mount the controller on a wall with adequate lighting, at a convenient level and accessible for adjustments. Avoid locations where the controller would be subjected to extreme cold or heat [less than 0°F (-17.8°C) or greater than 122°F (50°C)], direct sunlight, vibration, vapors, liquid spills or EMI (electromagnetic interference; i.e., strong radio transmission). Installation should comply with all national, state and local codes.



Accessories

(Available through your Pulsafeeder distributor or sales representative, but not included as standard)

1. Two manual gate valves, one on each side of the electrode or flow assembly if controller incorporates a flow switch, to isolate the electrode or flow assembly for installation and routine maintenance.
2. One Y-strainer before flow assembly.
3. Chemical metering pumps as required.
4. External alarm, if controller incorporates alarm relay.
Refer to Figure 2, Typical Installation.

Installation Notes

1. Install sensors or sample stream flow assembly at some point before chemical injection points, where chemical and water are thoroughly mixed. Refer to Figure 2, Typical Installation.
2. Measuring surfaces of the sensor electrodes must be continuously immersed in system water.
3. Inlet pressure of the sample flow assembly must be higher than the outlet pressure so water will flow past the sensors. Flow rate must be at least 1 GPM.
4. Install strainer on the upstream side of the flow assembly.
5. Install hand valves on each side of the flow assembly for easy isolation and removal of sensors and strainer screens.

6. Direction of flow should be from the bottom to the top of the flow assembly. Refer to Figure 2, Typical Installation.

!!WARNING!!

The standard flow assembly, if provided with this controller, is constructed of durable glass filled polypropylene (GFPPL).

Standard connection to flow line is 3/4" NPT, but we have provided a PVC thread to slip adapter so that a PVC weld joint, if preferred, can be made.

If NPT connections are used, hand tighten until snug, then tighten an additional half turn.

Mounting

Mount controller on a wall or other vertical surface. Position so operator has access to the unit and a clear view of front panel display. Refer to Figure 3, Standard Enclosure Dimensional Data and Mounting Hole Template for mounting details of our standard enclosures. An actual size Mounting Template (Attachment A) is provided for your convenience.

Electrode Information

!!WARNING!!

Care should be exercised when removing the protective rubber boot from the ORP electrode. Submerge the tip of the electrode in water to loosen the protective boot and remove. Save for future storage. Care should also be taken to prevent the glass bulb from hitting the tee or other piping. Never expose electrode to air with power on for more than 45 seconds. Never allow electrode to dry out.

To remove electrode from its tee for cleaning and for reinstallation, keep the following in mind:

1. Remove power from the system.
2. Remove pressure from the system prior to unscrewing the electrode. To remove pressure, close hand valves located before and after flow assembly.
3. Open the sample port. This will facilitate removal of electrode.
4. Unscrew the coupling nut.
5. Remove electrode. If necessary, assure slot on nut and dimples on electrode or electrode holder are NOT lined up.
6. Reinsert electrode; conductivity electrodes are keyed.
7. Hand tighten nut.
8. Close sample port.
9. Reapply pressure and flow by opening hand valves slowly to avoid water hammer.
10. Reapply power to the system.
11. You should calibrate sensor at this time.

Refer to Figure 4, TON-1 Electrode, and Section 4, Maintenance for specific information and specification for electrodes supplied with your system.

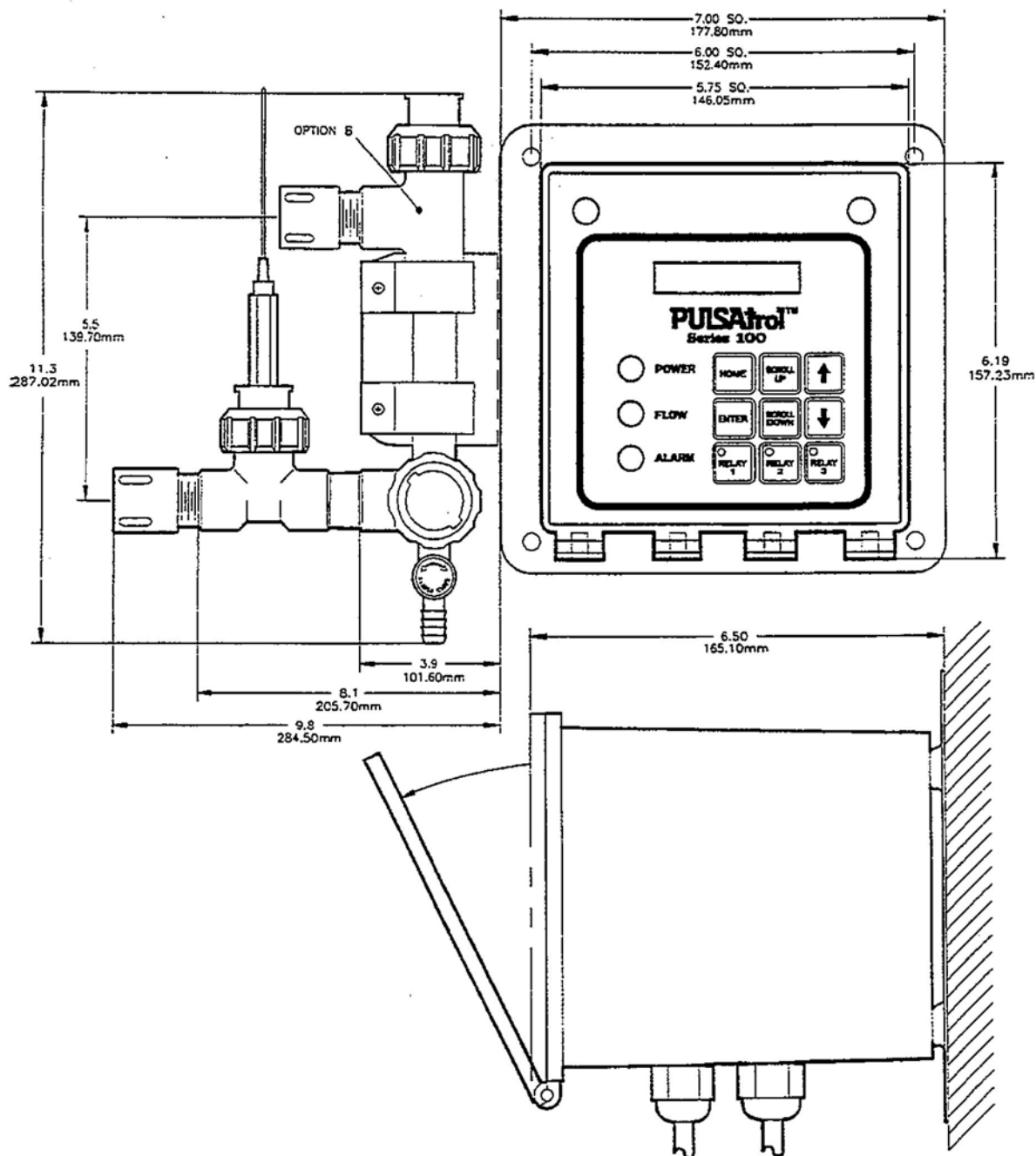


Figure 3, Enclosure Dimensional Data

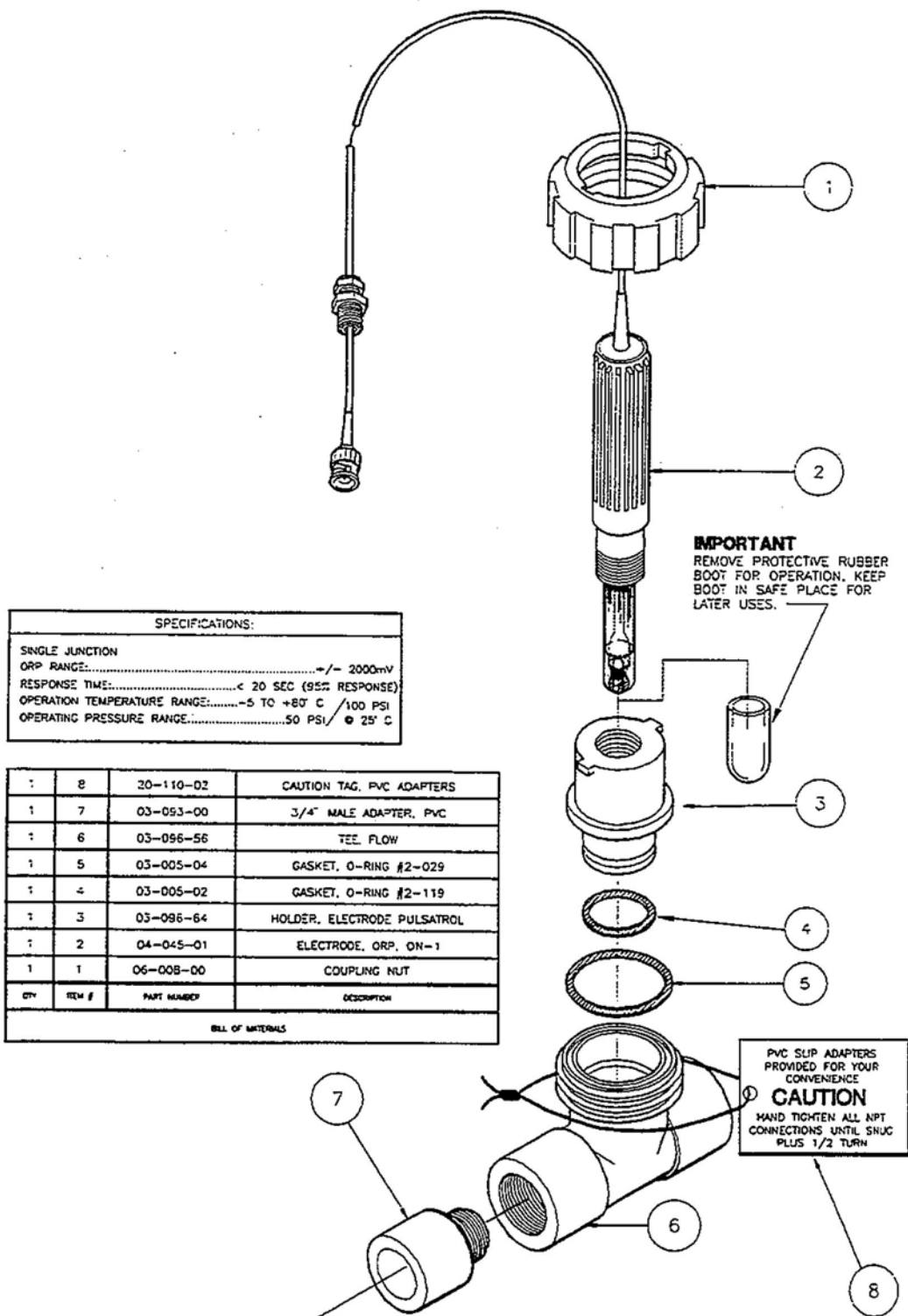


Figure 4, TON-1 Electrode

Electrical Wiring

The PULSAtrol™ Series 100 electronic circuitry is protected by a (Bussman BK/PCE-1) 1 amp fuse (F4). Each output relay is individually protected by replaceable (Bussman BK/PCE-5) plug-in 5 Amp fuses (F1, F2 & F3) located on the power supply/relay board. Refer to Figure 5, Power Supply/Relay Board.

!!CAUTION!!

Line voltage is present on the relay/power supply board located in the bottom of enclosure, even when power is off.

POWER MUST BE DISCONNECTED WHILE CONNECTIONS ARE BEING MADE!

Note: For proper rejection of AC line voltage spikes, sensor EMI noise rejection and personal safety, the case ground (SAFETY GROUND) must be properly installed. If there is ANY doubt, consult a qualified electrician.

Prewired units are supplied with 10 foot, 18 AWG 3 wire grounded power cords and clearly marked 18 AWG 3 wire grounded receptacle cords for all controlled line voltage outputs.

Conduit units are factory predrilled with easily accessible terminals for hard wiring. See Figure 5, Power Supply/Relay Board, for input and output power connections. Use only 16 or 18 AWG wire for conduit power and load connections. Never run power and signal wiring (sensor, proportional or recorder outputs) together in the same conduit.

When connections are required by user, follow the instructions below:

Note: Liquid tight fittings are provided for all signal leads.

Open Enclosure

- *Remove the screws from upper control panel and lower control panel.*

Flow Switch or Interlock

It is recommended that a flow switch or auxiliary dry contact from the control panel be used to make outputs inoperative when the circulating pump is shut down. This connection is provided for on all units with or without mounted flow assembly. If a flow switch is not ordered with the unit, this function will be inoperative. To use the interlock feature, connect a flow switch or auxiliary dry contact from another device. Refer to Figure 6, Daughter Board, for flow switch or interlock connection marked JP1 pin 7 and 8. To activate function, turn switch S1-"2" (located on the Mother Board, Figure 7) on. Turn power off, wait 15 seconds and turn power back on.

Sensor Connections

Units supplied with GFPPPL flow assemblies (option B) come from the factory with all sensors pre-connected. Refer to Figure 6, Daughter Board, for location of sensor connections.

Alarm Dry Contact

Alarm dry contacts (Rated @ 500 mA) are provided when Option K has been ordered for user connection. Refer to Figure 5, Power Supply/Relay Board.

Receptacles

The PULSAtrol™ offers a unique prewired package that allows it to maintain its NEMA 4X rating even though it is prewired for easy installation. Each cord is clearly marked and readily accessible for connecting external electrical devices to be controlled.

Note: The solid state relays used in the PULSAtrol™ result in a small leakage current at all receptacles. While this can possibly be detected by a voltmeter, it is insufficient to power any typical electrical device.

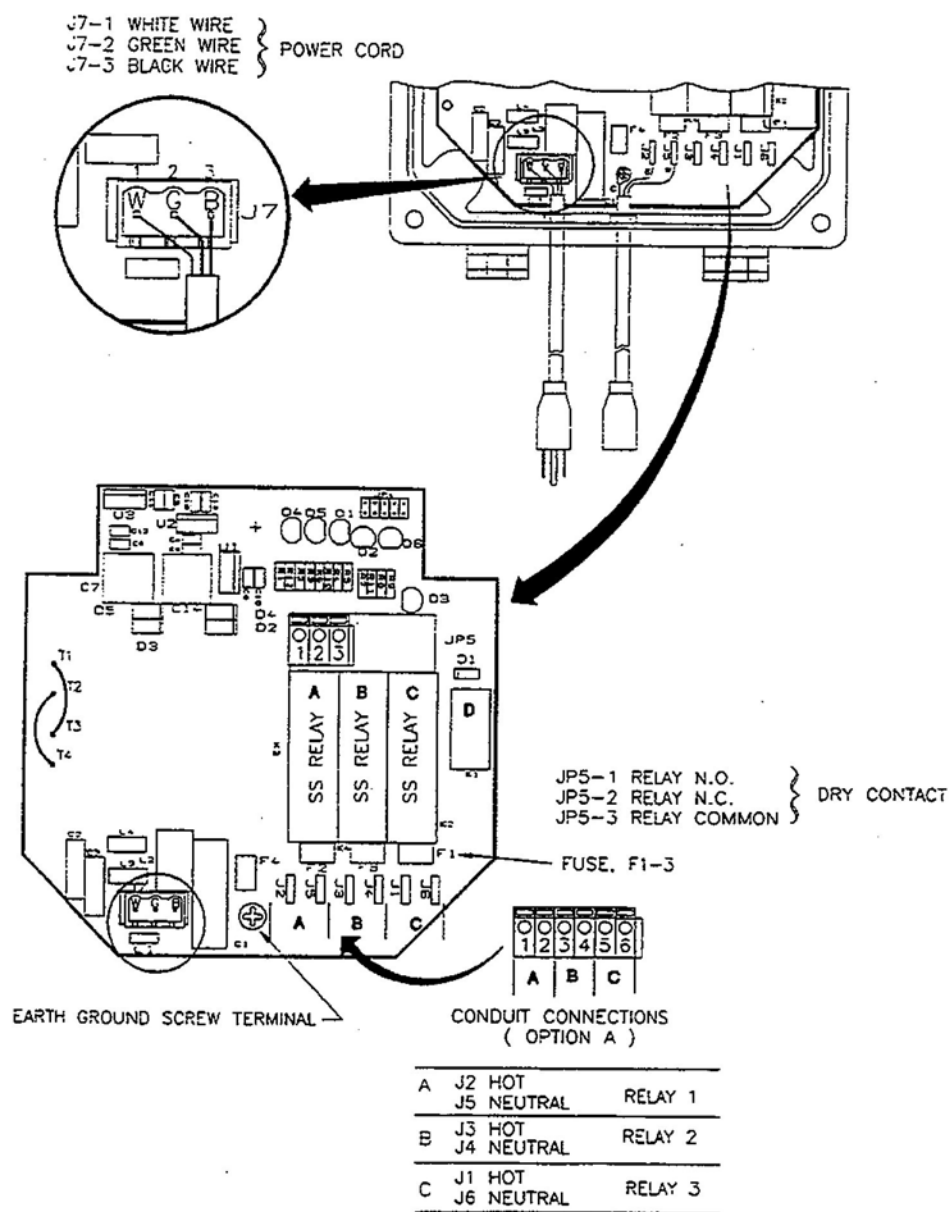
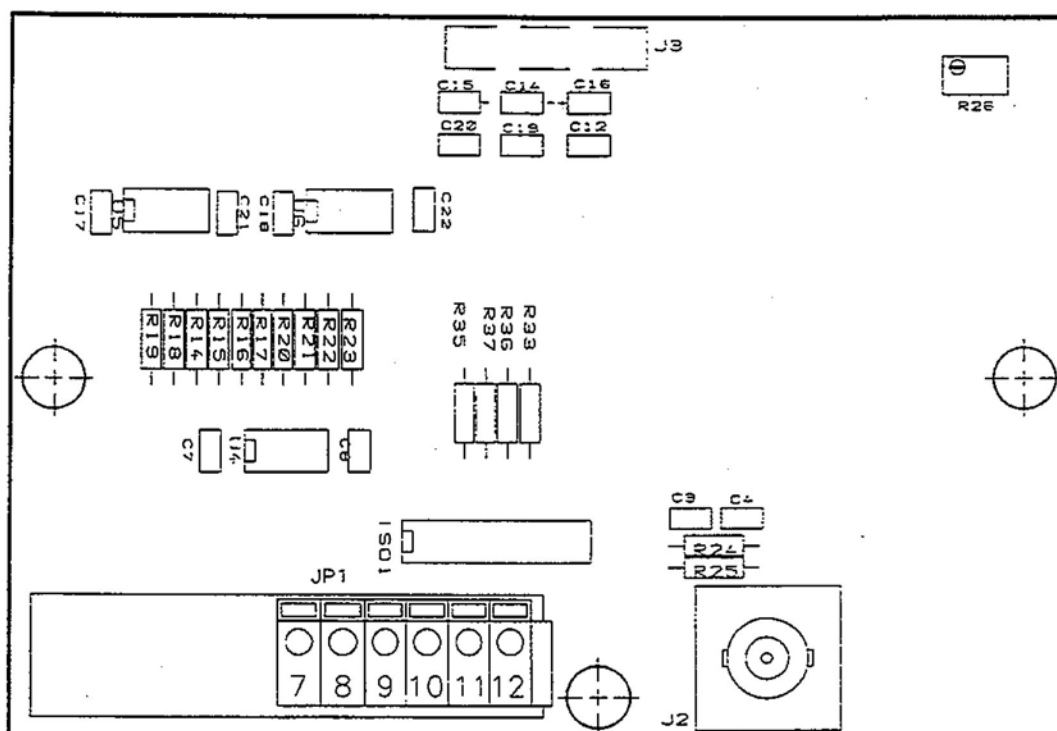


Figure 5, Power Supply/Relay Board



J2 ORP IN

JP1-7	DINO	FLOW SWITCH
JP1-8	DINO	
JP1-9	DIN1	WATER METER
JP1-10	DIN1	
JP1-11	AOUT+	ANALOG OUT
JP1-12	AGND-	

Figure 6, Daughter Board

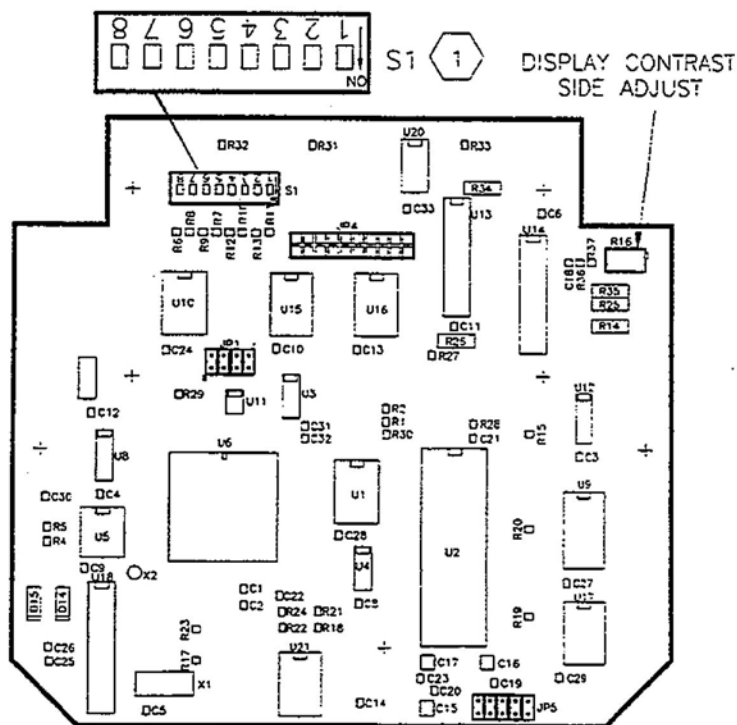
READ THE FOLLOWING BEFORE PROCEEDING ANY FURTHER!!

This unit requires initialization upon start-up. Directions are as follows:

1. Before power is supplied, remove the two screws holding the front cover closed with a phillips screwdriver.
2. Locate switch S1 on the mother board. Assure switch S1-"8" is in the "on" position.
3. With the front cover closed, power unit up for 15 seconds. Remove power, open front cover and turn S1-"8" off.
4. Close front cover. Turn power on and configure the controller per the user's manual.

CAUTION!!

When power is supplied to the unit, 115 VAC is present on the power supply/relay board located in the bottom of the enclosure.



JP4 HEADER FOR OPTION BOARD

S1-1	OFF	
S1-2	OFF- FLOW DISABLED	ON- FLOW ENABLED
S1-3	OFF	
S1-4	OFF	
S1-5	OFF	
S1-6	OFF	
S1-7	OFF	
1 S1-8	OFF- OPERATE	ON- FACTORY REINIT

1 FACTORY REINIT:

- STEP 1- REMOVE POWER FROM UNIT
- STEP 2- SET S1-"8" TO "ON" POSITION
- STEP 3- RESTORE POWER TO UNIT FOR 15 SECONDS; REMOVE POWER
- STEP 4- SET S1-"8" TO "OFF" POSITION, CLOSE COVER AND RESTORE POWER
- STEP 5- CONFIGURE CONTROLLER

Figure 7, Mother Board

Section 2 - General Instructions

Menu Structure

The PULSAtrol™ menu structure, as well as the hardware, were designed with the user in mind. The menu structure diagram supplied with the controller was generated to reflect a PULSAtrol™ model MCT130. The laminated "MENU MAP" supplied with your controller reflects your system with options.

Display Data All PULSAtrols™ have a display data menu. This menu displays system parameters only and no settings or adjustments are made through this menu.

Calibrate Sensor All PULSAtrols™ with analog input, such as conductivity, have this menu. In this menu, the user is prompted to choose either 2 or 3 point calibration. After a choice is made, the user is prompted to enter value of LO, MID (if 3 point is chosen) and HI calibration solution.

Set Points and Alarms All PULSAtrols™ with analog input, such as conductivity, pH or ORP, have this menu. In this menu, the user is prompted to enter all settings pertaining to alarms and set points.

System Configure All PULSAtrols™ have a system configure menu. In this menu, the user is prompted to configure system functions to the specific application. System Configure can include such things as time of day, date, rising or falling set point, follow set point or independent set of high/low alarm and the selection of the inhibitor feed mode.

Note: After five minutes of no keypad activity, the controller will display system ORP.

Section 3 - Start-Up

General Information

Before applying power, insure that devices being controlled are not in a position to cause harm or damage if activated upon initial start-up.

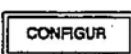
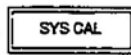
With the controller now installed in a convenient location, supply power to the controller. The power LED indicator light will be illuminated. When the controller is powered up, it will display .

The PULSAtrol™ is a flexible yet powerful controller. The default values for all "Control" features have been factory set, but you will want to fine tune the controller to meet your specific application.

Continue by configuring the controller functions.  or  to , press .

Configure Analog Input

Note: For help with menu locations, refer to the "MENU MAP" supplied with your controller.

1. Proceed by configuring controller as prompted, "HI/LO AL". Press  and use the   keys to choose alarm configuration: "TRAKSET", tracking set point, or "INDEPEND", independent set of high and low alarms, press . "SET PT" will be displayed.
2. Press  and  to display the desired set point configuration: "RISING" or "FALLING". Press  to enter your selection, "VERSION" will be displayed.
3. Press  to display the software version. Press  again and "SENSITIV" will be displayed.
4. Press  and "1" or the last setting entered will be displayed, 1 being the most sensitive and 20 being the least. The setting determines the number of samples that are averaged together and the number of seconds before a new reading is displayed. This reduces the typical fluctuation of digital displays. Use the   keys to set the desired sensitivity and press  to enter your sensitivity setting. If no options are present, "HI/LO AL" will be displayed.
5. If other options are present, continue with step 5. If no options are present, skip step 5 and continue with step 6. Refer to the option instructions supplied with your owner's manual and configure options as instructed.
6. Press  again and  is displayed.  or  to access .

System Calibration

Note: For help with menu locations, refer to the "MENU MAP" supplied with the controller.

!!WARNING!!

Care should be exercised when removing the protective rubber boot from the ORP electrode. Submerge the tip of the electrode in water to loosen the protective boot and remove. Save for future storage. Care should also be taken to prevent the glass bulb from hitting the tee or other piping. Never expose electrode to air with power on for more than 45 seconds. Never allow electrode to dry out.

Calibration Notes

1. Verify calibration before proceeding with start up.
2. For a higher degree of accuracy, three point calibration should be utilized using three standard buffer solutions, if available.
3. Between each sample, rinse sensor with buffer to be sampled.
4. Refer to solutions A and B in Section 4, Maintenance, for other mV solutions to be used for calibration.

IMPORTANT

Always put the sensor in calibration solution before, or while the low, middle, or high calibration steps are being displayed and before pressing .

5. Make sure probe is clean (refer to Section 4, Maintenance) before proceeding with system calibration.
6. Obtain a sample of system water from the sample flow stream and test the sample with a reliable tester. If the tester and the PULSAtrol™ agree, proceed with programming parameters. If not proceed with system calibration.

Calibration Procedure

Note: To verify that calibration has been accepted, refer to the display data (SYS DATA) main menu.

1. or through the displayed main menus to the calibrate sensor menu.
2. Press , 2/3 PT will be displayed. or to "2 POINT" OR "3 POINT" calibration.
Press and "LO CAL" will be displayed. Press ¹ and use the keys to set the value of calibration buffer solution. Press to enter the "LO CAL" point. "MID CAL"² will be displayed.

¹When pressing from "LO CAL", "MID CAL", or "HI CAL", the displayed value is what the electrode is presently reading.

²"MID CAL" is displayed only if "3 POINT" calibration was chosen. This step is not required for "2 POINT" calibration.

3. Press **ENTER** and use the **↑** **↓** keys to set the value of calibration buffer solution. Press **ENTER** to enter the "MID CAL" point. "HI CAL" will be displayed.
4. Press **ENTER** and use the **↑** **↓** keys to set the value of calibration buffer solution. Press **ENTER** to enter the "HI CAL" point. "LO CAL" will be displayed.
5. Press **HOME** to return to "2 POINT" OR "3 POINT".
6. Press **HOME** again and the **SYS CAL** main menu is displayed. **SCROLL DOWN** or **SCROLL UP** to access "SET PTS".

Program Parameters

Note: For help with menu locations, refer to the "MENU MAP" supplied with your controller.

Set Points & Alarms

Rising or Falling Set Points Every analog input has a set point (trip point), the setting at which the controller activates an output, such as a solenoid valve when conductivity set point is exceeded or an acid pump if ORP exceeds a desired limit.

*Set point display abbreviations ... ORP Rising Set Point - "ORP RSP"
ORP Falling Set Point - "ORP FSP"*

1. **SCROLL UP** or **SCROLL DOWN** through the displayed main menus to "SET PTS".
2. Press **ENTER**. One of the above abbreviations will be displayed depending on the set point configuration.
3. Press **ENTER** and the factory setting or the last set point entered will be displayed blinking. Use the **↑** **↓** keys to set the desired set point. Press **ENTER** to enter the set point value. "AL OFFST"¹ will be displayed.

*High or Low Alarm Settings Every analog input has a high/low alarm. The alarms can be configured one of two ways. The controller is factory configured to track the set point "TRAK SET". An alarm offset is entered that sets the alarm point above and below the set point of the controller. Example: With an "AL OFFST" of 20, if the set point is 800 the high alarm would be at 820 and the low alarm at 780. The high/low alarms can also be configured with independent set points for the "HI ALARM" and the "LO ALARM". This is accomplished through the **CONFIGUR** menu.*

¹"AL OFFSET" is displayed only if "HI/LO AL" is configured to track the set point. If so, skip steps 5 and 6. If HI/LO AL" is configured for independent setting of high/low alarm, skip step 4 and proceed with step 5.

*Alarm display abbreviations: Alarm Offset - "AL OFFST"
High Alarm - "HI ALARM"
Low Alarm - "LO ALARM"*

4. Press and the factory setting or the last alarm offset entered will be displayed blinking. Use the keys to set the desired alarm offset. Press to enter the "AL OFFST". "SPT DIF" will be displayed.
5. Press and the factory setting or the last high alarm entered will be displayed blinking. Use the keys to set the desired high alarm setting. Press to set the "HI ALARM". "LO ALARM" will be displayed.
6. Press and the factory setting or the last low alarm entered will be displayed blinking. Use the keys to set the desired low alarm setting. Press to set the "LO ALARM". "SPT DIF" will be displayed.

Set Point Differential Also referred to as dead band or Hysteresis. The offset applied to a set point to prevent chattering of an output relay around a set point.

Display Abbreviation Set Point Differential - SPT DIF

7. Press and the factory setting or the last set point differential (dead band or hysteresis) entered will be displayed blinking. Use the keys to set the desired differential. Press to set the "SPT DIF". "ORP TIMER" will be displayed.

Limit Timer Also referred to as lockout timer or feed limit timer. Displayed only if analog input is pH or ORP. It limits the amount of time output is activated. Timer is adjustable in 1 minute increments up to 24 hours; factory set for 1 hour 30 minutes.

8. Press and the factory setting or the last minutes entered will be displayed blinking. Use the keys to set the desired minutes. Press to set the minutes. The hours will be displayed blinking.
9. Use the keys to set the desired hours. Press to set the hours. The set point abbreviation displayed in step two will be displayed.
10. Press to return to "SET PTS". or for other main menus.

Section 4 - Maintenance

Maintenance on the PULSAtrol™ MCT130 controller requires only that the operator periodically clean the electrode(s). All other service should be performed by factory authorized personnel only. Modifications to or tampering with the circuit level components makes all warranties, written or implied, and/or manufacturer's responsibility for this controller null and void.

ORP Electrode Information

ORP standard buffers are not readily available, making it difficult to standardize ORP systems against buffers. The following solutions (A and B) can be easily mixed. Like pH electrodes, ORP sensors are subjected to coating and abrasion by the measured liquid and, in certain instances, are "poisoned" by chemicals which may be present if the system goes out of control. To improve the reliability of ORP measurement and control, the following is a means of testing electrodes in solutions of standard potential, which will determine if electrodes are responding correctly or need maintenance attention.

Testing ORP Sensor

Solution A

- Use sufficient pH buffer 7 to immerse electrodes. Dissolve sufficient crystals of quinhydrone to saturate solution. This may be evidenced by undissolved crystals suspended in solution. Immerse electrode into liquid and measure potential. Potential would be within +/- 10 mV of the following values:

Temperature °C	20	25	30
Potential, mV	+92	+86	+79

Solution B

- Remove electrodes and rinse thoroughly with water. Make up a second saturated quinhydrone solution with pH buffer 4. Immerse electrodes. There should be a rapid response to the following potential:

Temperature °C	20	25	30
Potential, mV	268	+263	+258

The millivolt difference between the two solutions is theoretically 177 mV. The absolute values may shift upward or downward a few millivolts due to slight variations from theoretical potential by the reference electrode.

If system potentials are correct, flush electrodes with deionized water and measure the liquid in question. If incorrect by more than 10 mV, electrodes should be cleaned with aqua regia (three volumes hydrochloric acid, one volume concentrated nitric acid. *Note: Solutions are very corrosive! Handle with extreme care*). Repeat above tests. Once satisfactory readings are obtained, install electrode and make measurements of liquid in question. *Note: Quinhydrone buffer solutions are not stable; discard immediately after use.*

Section 5 - Troubleshooting Guide

If your controller is not operating properly, proceed through the troubleshooting instructions below.

Mother Board		
Symptom	Probable Cause	Possible Solution
NO DISPLAY (See Power Supply first)	Improper contrast	Adjust contrast on mother board. See Figure 7.
	Environment exceeds 122°F (50°C)	Relocate controller.
ERRATIC READINGS	Improperly grounded power	Assure power and ground integrity. Shields of all sensors should be connected at controller end only.
FLOW LIGHT NEVER ACTIVATES	Function not activated	Turn switch S1-2 on mother board ON . See Figure 7.
FLOW LIGHT STAYS ON	Flow switch stuck	Clean flow switch.
Power Supply/Relay Board		
NO POWER LIGHT	Blown fuse	Replace fuse on the board.
	Interconnecting cables loose	Check connections.
	No power supplied	Check power source.
NO OUTPUTS	If the output front panel LED is lit: • ribbon cable • blown fuse • bad relay	Check ribbon cable connection or replace. Replace fuse. Replace power supply/relay board.
Cooling Tower ORP		
INABILITY TO CALIBRATE ORP	Fouled ORP sensor	Clean sensor.
	Bad ORP sensor	Replace sensor.

ORP FEED LED OFF AND: ORP ABOVE RISING SET POINT	Limit timer timed out	Solve problem and limit timer will reset itself: Chemical drum empty. Sample line blocked.
ORP BELOW FALL- LING SET POINT	Limit timer timed out	Fouled pH sensor. Bad pH sensor.
Reinitialization		
If the above troubleshooting steps fail to explain or solve condition, factory reinitialize (see Figure 5, Mother Board). If condition still exists, contact factory for customer service assistance at 1-800-333-6677. A RA (Return Authorization) number is required for any return.		